

VCS Module

VMD0060

COMBINED BASELINE AND ADDITIONALITY ASSESSMENT FOR ACCELERATED RETIREMENT OF COAL- FIRED POWER PLANTS

Version 1.1

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Sectoral Scope 1: Energy supply

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1 SUMMARY DESCRIPTION

This module establishes criteria and procedures to determine the baseline scenario and baseline retirement date and to demonstrate the additionality of project activities that accelerate the retirement of a coal-fired power plant (CFPP) using VM0052 *Accelerated Retirement of Coal-fired Power Plants Using a Just Transition*.

2 SOURCES

This module is used in combination with VM0052 and the following tools:

- VCS tool VT0009 *Combined Baseline and Additionality Assessment*
- Paris Agreement Crediting Mechanism tool A6.4-AMT-006 *Determination of the Technical Lifetime of Equipment*

3 DEFINITIONS

In addition to the definitions in the VCS *Program Definitions* and VM0052, the following definitions apply to this module.

Asset-level phaseout plan

A documented and approved plan to retire coal-fired power plants (and other fossil fuel power plants) in a jurisdiction (national or subnational) where the plan specifies the retirement date of each power plant. Both the jurisdictional government and independent power producer (IPP) can have an asset-level phaseout plan. However, only government plans are considered legally binding.

Coal transition mechanism (CTM)

Financial products and services designed to facilitate the managed transition of a coal-fired power plant that has remaining fair value to its owners, by changing the underlying cost of capital of the plant or its revenues to deliver necessary returns. Carbon market mechanisms leveraging revenue generated from carbon credits, including compliance markets, voluntary carbon markets, and Article 6 are excluded.

Jurisdictional-level phaseout plan

A documented and approved commitment by the jurisdictional (national or subnational) government that specifies the phaseout date for all coal-fired power plants in the jurisdiction,

without specifying individual retirement dates. This overall phaseout date is considered legally binding for all coal-fired power plants within the jurisdiction.

Regulatory asset

A financial tool that allows a utility to continue to include an asset in its rate base and, therefore, continue to realize a return on and recovery of capital on the asset, even after the asset has ceased operation.

Required revenues

Annual revenue that a regulated utility must earn to provide adequate service to its customers and the allowed return for its shareholders.

4 APPLICABILITY CONDITIONS

This module applies to project activities related to the accelerated retirement of a CFPP using VM0052.

5 BASELINE SCENARIO

Project proponents must determine the most plausible scenario that would have occurred in the absence of the project activity. The baseline scenario identified through the process outlined below is used to inform the assessment of project additionality in Section 7.

5.1 Baseline Scenario for the CFPP

Project proponents must accurately determine the activities and greenhouse gas (GHG) emissions that would have occurred in the absence of the project activity.

For the following steps (Sections 5.1.1–5.1.4), the applicable geographic area is determined in accordance with VCS tool VT0009 *Combined Baseline and Additionality Assessment*.

5.1.1 Step 1: Identify Alternative Scenarios

Project proponents must identify and assess all credible alternative baseline scenarios to the proposed project activity. This assessment must include at least the alternative baseline scenarios listed below. Project proponents must also consider other plausible alternatives that deliver a similar output and have been previously implemented or are currently under development in the applicable geographic area.

Baseline scenario B1: The CFPP continues to operate until the baseline retirement date determined in Section 0.

Baseline scenario B2: The CFPP is retired ahead of the technical end of life, end of long-term power purchase agreement (PPA), date of regulatory phase out, or as specified in a transition mechanism (i.e., accelerated retirement) and without being registered with a GHG program.

Baseline scenario B3: The CFPP is repurposed for firing natural gas, co-firing biomass and coal, or firing exclusively biomass.

Baseline scenario B4: The retirement of the CFPP is accelerated and the salvage value of major components is recovered through their transfer to and reuse at other plants.

5.1.2 Step 2: Check Consistency with Mandatory Applicable Laws and Regulations

Project proponents must remove alternative scenarios that do not comply with mandatory laws and regulations as well as the Nationally Determined Contribution (NDC) in the applicable geographic region where the project is located, following Step 1b of VT0009.

5.1.3 Step 3: Barrier Analysis

Project proponents must use Steps 2a and 2c of VT0009¹ to identify and assess potential barriers to implementation of the alternative baseline scenarios remaining after Step 2 in Section 5.1.2 of this module. In addition to the barriers listed in Step 2a of VT0009, the following barriers may prevent the alternative scenarios from occurring:

- 1) Systemic, logistic, or supply chain barriers, for example:
 - a) Inadequate or outdated infrastructure and/or high cost of developing natural gas infrastructure
 - b) Lack of access to or high cost of sourcing a reliable supply of natural gas, other fossil-fuels, or biomass feedstocks
 - c) Risk of unreliable long-term fuel supply of natural gas, other fossil fuels, or biomass feedstocks
 - d) Risk of unmanageable fuel price volatility of natural gas, other fossil fuels, or biomass feedstocks that increases operational and financial uncertainty for investment in re-purposing

Eliminate from further consideration the alternative scenarios that are prevented by at least one (1) barrier. Baseline scenario B2 cannot be eliminated through the barrier analysis.

¹ Step 2a: Identify Realistic and Credible Barriers and Step 2c: Demonstrate That Barriers Would Not Prevent Implementation of at Least One Alternative in VT0009

5.1.4 Step 4: Identifying the Baseline Scenario

If only baseline scenario B2 remains after applying Step 3 (Section 5.1.3), the project is not eligible under VM0052, as the project activities would also occur in the baseline.

If baseline scenarios B3 and/or B4 remain, the project is not eligible under VM0052.

If only scenario B1 or both scenarios B1 and B2 remain, demonstrate that alternative scenario B2 is not financially attractive using Section **Error! Reference source not found.** in this module.

Project proponents must demonstrate that the most plausible alternative without carbon revenues (i.e., the baseline scenario) is scenario B1 and use that scenario in the additionality assessment in Section 7.

5.2 Baseline Scenario for Paired Renewable Electricity

The baseline scenario for the renewable electricity power plants paired with the project is that they would not have been built or commissioned before their baseline scenario operational start date or the baseline retirement date of the CFPP determined in Section 0.

Using this common baseline, all renewable electricity plants, regardless of pairing pathway, are included in the financial assessment in Section 6.5 until the date when they would have been operational in the baseline scenario.

The rationale for this baseline for each type of pairing pathway follows.

- **Contractual pairing:** The baseline retirement date serves as the point in time when there is demand for capacity that the contractual paired renewable electricity meets. Project proponents with contractual pairing must demonstrate the baseline operational date using previous submissions to regulators, or agreements with third parties that are obsolete or amended because of the advancement of the operational date as a result of the project activity.
- **Financial pairing:** Financing for the construction of the paired renewable electricity power plant is dependent on retirement of the CFPP. Financial pairing includes cases in which the cost of debt for clean energy is tied to CFPP retirement or GHG emission reductions, or where the lending terms are dependent on clean replacement being provided when retiring the CFPP.
- **On-site pairing:** The new renewable electricity plant is built on the site of the existing CFPP and its construction cannot take place until the CFPP is retired.
- **Regulatory pairing:** Approval for the construction of the renewable electricity plant by the regulator is dependent on retirement of the CFPP.

6 BASELINE RETIREMENT DATE

The baseline retirement date for the CFPP represents the date upon which the CFPP would cease operation in the baseline scenario and is the earliest date determined in Sections 6.1–6.5.

6.1 Regulatory CFPP Phaseout Date

The retirement date is imposed at the jurisdictional or asset level by existing regulations, plans, strategies, or commitments at the national or subnational level, through any of the following:

- 1) A coal phaseout date specified in a country's NDC. The project proponent must refer to the most recent version of the country's NDC communication² at the time of submitting the project for registration.
- 2) A coal phaseout date stipulated in the grid's most recent integrated resource or electricity sector plan, which has been approved by the public regulator, electricity regulator, or electricity sector governing body
- 3) A coal phaseout date set in national or subnational legislation, law, or executive mandate
- 4) For a jurisdictional-level phaseout plan, such as a commitment to phase out all CFPPs by 2040, the commitment date is considered the regulatory CFPP phaseout date. For asset-level phaseout plans, the CFPP retirement date under this plan is considered the regulatory CFPP phaseout date.

6.2 End of Technical Life

Project proponents must use A6.4-AMT-006 *Determination of the Technical Lifetime of Equipment* to determine the remaining technical life of the CFPP.

6.3 End of Long-term Power Purchase Agreement (PPA)

The end date is determined to be the end of the existing long-term PPA. PPAs or PPA extensions executed after 31 December 2023 are not eligible, and the original end date of the agreement must be used.

6.4 Committed Coal Transition Mechanism (CTM)

This is the announced retirement date of the CFPP under a CTM, where either of the following conditions have been met:

- 1) The financial closure of a transaction, demonstrated through one of the following:

² The most recent version of the NDC can be referenced from the UNFCCC NDC registry. Available at: <https://unfccc.int/NDCREG>

- a) Transfer of ownership of the CFPP or equity investment, or full/partial buyout of equity shares of the CFPP
 - b) Development of a special purpose vehicle or fund to invest in the CFPP, refinancing, or new financing agreement that would lower the existing cost of capital (e.g., by lowering the cost of equity, cost of debt, leverage ratio, or required returns of the CFPP)
- 2) The signing of an electricity contract for a defined early retirement, such as a PPA, PPA renegotiation, or other contractual agreement detailing retirement ahead of the CFPP's current PPA term or technical life

6.5 Financially Attractive Retirement

The accelerated retirement of a CFPP is considered financially attractive when retiring the CFPP and replacing the coal-generated electricity with renewable electricity results in a financial gain compared to continued operation.

The earliest date at which retirement can be considered financially attractive is determined using the financial analysis outlined in Sections 6.5.1–6.5.2.

6.5.1 Determining Financially Attractive Retirement Date

The financially attractive retirement date represents the earliest year in which retiring the CFPP with paired renewable electricity according to the pairing plan is at least as financially attractive as continuing to operate the CFPP.

To identify this date, project proponents must compare the net present value of required revenues of the following scenarios related to the operation of the CFPP:

- Continued operation (CO) of the CFPP
- Accelerated retirement (AR) of the CFPP paired with renewable electricity and grid-connected power sources

The comparison is made using Equation (1):

$$NPVRR_{S,CO} \geq NPVRR_{S,AR} + NPVRR_{S,AR} \quad (1)$$

Where:

$NPVRR_{S,CO}$	=	Net present value of required revenues associated with the CFPP for stakeholder S under continued CFPP operation (currency unit)
$NPVRR_{S,AR}$	=	Net present value of required revenues associated with the CFPP for stakeholder S under CFPP retirement in year AR (currency unit)
$NPVRR_{S,AR}$	=	Net present value of required revenues for replacement generation for stakeholder S following CFPP retirement in year AR and until RY

S = Stakeholder (regulated utility = utility, independent power producer = IPP, independent power producer from the point of view of the off-taker = IPP-F)

Project proponents must make this comparison for each year of the assessment period until they identify the first year in which Equation (1) is true (i.e., where the net present values of required revenues for the *AR* scenario are equal to or less than those of the *CO* scenario). The assessment period is the period between the year in which the baseline scenario analysis is carried out (referred to as *RO*) and the retirement year (*RY*).

RY is determined as the end year of the shortest period represented by one (1) of the following:

- 1) 20 years (standard period for required revenue calculations)
- 2) For a CFPP owned by a regulated utility, the remaining technical life determined as per Section 6.2
- 3) For a CFPP owned by an IPP with a long-term PPA, the remaining number of years under the existing PPA

In the *CO* scenario, it is assumed that the CFPP would continue to operate for the entire assessment period.

Project proponents must perform a sensitivity analysis as outlined in section 7.2.3 on parameters and assumptions underlying the financially attractive retirement date identified.

6.5.2 Calculating Net Present Value of the Required Revenues

The net present value (NPV) of the required revenues for the *CO* and *AR* scenarios used in Equation (1) must:

- 1) include the value of the electricity generated in the financial assessment period.
- 2) be determined in real terms, using values that were relevant at the time of investment decision for the project activity.
- 3) exclude any expenditures that occurred prior to the decision to proceed with retiring the CFPP.

All assumptions, data, and conclusions in the calculation of NPV of the required revenues must be:

- a) transparently documented in the project description.
- b) appropriately justified and substantiated by verifiable evidence.
- c) relevant and appropriate to the project circumstances.
- d) consistent with information presented to the company's decision-making management and to investors/lenders.

6.5.2.1 Required Revenues for the CFPP (NPVRRC)

The required revenues associated with the CFPP for continued operation ($NPVRRC_{S,CO}$) and accelerated retirement ($NPVRRC_{S,AR}$) must be determined using one of the following approaches.

Approach 1: Where the CFPP is owned by a regulated utility (stakeholder S = utility), use Equation (2) to determine the required revenues ($NPVRRC_{S=utility,CO}$ and $NPVRRC_{S=utility,AR}$) for use in Equation (1) to determine the financially attractive retirement date.

Approach 2: Where the CFPP is owned by an IPP, the following steps apply:

- 1) Use Equation (2) to determine the required revenues ($NPVRRC_{S=IPP,CO}$ and $NPVRRC_{S=IPP,AR}$) and evaluate Equation (1) to determine the financially attractive retirement date for the IPP (stakeholder S = IPP).
- 2) Use Equation (4) to determine the required revenues ($NPVRRC_{S=IPP-F,CO}$ and $NPVRRC_{S=IPP-F,AR}$) and evaluate Equation (1) to determine the financially attractive retirement date for the off-taker (stakeholder S = off-taker F).
- 3) Use the earlier of the financially attractive retirement dates determined in (1) and (2).

Equation (2) evaluates the required revenues from the perspective of the CFPP plant owner:

$$NPVRRC_{S,AR \text{ or } CO} = \sum_{y=R0}^{y=RY} EX_y + P_y + (AC_y + TERM_{AR} + DC_{S,RY} - CTM_y) \times (1 - H) - (DEP_{CFPP,y} \times H) + CAR_y \quad (2)$$

Where:

$NPVRRC_{S,AR \text{ or } CO}$	=	Net present value of required revenues associated with the CFPP for the stakeholder (S = regulated utility or IPP), in retirement year AR or for continued operation (CO) (currency unit)
y	=	Year of CFPP operation (dimensionless)
$R0$	=	Year of baseline assessment (dimensionless)
RY	=	Retirement year (dimensionless) determined in Section 6.5.1
EX_y	=	Capital expenditure including equity return of capital and equity return on capital in year y (currency unit)
P_y	=	Principal payment for asset-level debt in year y (currency unit)
AC_y	=	Annual costs in year y (currency unit)
$TERM_{AR}$	=	Contract termination costs in accelerated retirement year AR ; equal to zero (0) for continued operation (CO) (currency unit)
$DC_{S,RY}$	=	Present value of decommissioning costs as of accelerated retirement year AR or retirement year RY for continued operation (CO) (currency unit)

CTM_y	=	Revenue due to a coal transition mechanism in year y , where relevant; equal to zero (0) for continued operation (CO) (currency unit)
H	=	Total blended tax rate (%)
$DEP_{CFPP,y}$	=	Tax depreciation of CFPP asset in year y (currency unit)
CAR_y	=	Cost of carbon in year y (currency unit)
$WACC_S$	=	Weighted average cost of capital of stakeholder S (%)

Annual costs in year y (AC_y) are calculated using Equation (3).

$$AC_y = IDEBT_y + VOM_y + FOM_y + FUEL_y \quad (3)$$

Where:

AC_y	=	Annual costs in year y (currency unit)
$IDEBT_y$	=	Interest payment for asset-level debt in year y (currency unit)
VOM_y	=	Variable operations and maintenance costs in year y (currency unit)
FOM_y	=	Fixed operations and maintenance costs in year y (currency unit)
$FUEL_y$	=	Fuel costs in year y (currency unit)

Equation (4) evaluates the required revenues from the perspective of the off-taker for CFPPs owned by IPPs.

$$NPVRRRC_{S,AR \text{ or } CO} = \sum_{y=R0}^{y=RY} \frac{\left[\left((PPAE_y \times G_y) + (PPAC_y \times A_y) + (PPAS_y \times OS_y) + TERM_{AR} + DC_{S,RY} \right) \times (1 - H) \right] + CAR_y}{(1 - H) \times (1 + WACC_S)^{y-R0}} \quad (4)$$

Where:

$NPVRRRC_{S,AR \text{ or } CO}$	=	Net present value of required revenues associated with the CFPP for the stakeholder ($S = IPP-F$) in retirement year AR or for continued operation (CO) (currency unit)
y	=	Year of CFPP operation (dimensionless)
$R0$	=	Year of baseline assessment (dimensionless)
RY	=	Retirement year (dimensionless)
$PPAE_y$	=	Remuneration for electricity supplied to the grid under PPA contract in year y (currency unit per unit of generation, e.g., USD/MWh)
G_y	=	CFPP electricity generated and supplied to the grid in year y (MWh)
$PPAC_y$	=	Remuneration for available capacity under PPA contract in year y (currency unit per unit of available capacity)
A_y	=	Availability of CFPP capacity as per PPA in year y (capacity unit)

$PPAS_y$	= Remuneration for other electricity services in year y , where relevant (currency unit per unit of service)
OS_y	= Other yearly services provided by the CFPP in year y , where relevant (service unit)
$TERM_{AR}$	= Contract termination costs in accelerated retirement year AR ; equal to zero (0) for continued operation (CO) (currency unit)
$DC_{S,RY}$	= Present value of decommissioning costs as of accelerated retirement year AR or retirement year RY for continued operation (CO) (currency unit)
H	= Total blended tax rate (%)
CAR_y	= Cost of carbon in year y , included where carbon costs are passed to off-taker (currency unit)
$WACC_S$	= Weighted average cost of capital of stakeholder S , which must be the IPP from the point of view of the off-taker ($S=IPP-F$) (%)

6.5.2.2 Required Revenues for Replacement Electricity Generation ($NPVRRG_{AR}$)

Costs for replacement electricity generation (that was supplied to the grid) prior to CFPP retirement year AR are considered zero (0).

For all subsequent years in the financial assessment period, the replacement electricity will be obtained from sources connected to the grid, including paired renewable electricity. The replacement generation cost is determined based on the unit cost of generation multiplied by the amount of electricity that must be generated and supplied to replace the CFPP's expected generation.

The net present value of required revenues from replacement generation (that is supplied to the grid) is calculated as shown in Equation (5).

$$NPVRRG_{AR} = \sum_{y=AR}^{y=RY} \frac{UG \times G_y}{(1-H) \times (1+WACC_S)^{y-R0}} \quad (5)$$

Where:

$NPVRRG_{AR}$	= Net present value of required revenues for replacement generation following CFPP retirement in year AR (currency unit)
RY	= Retirement year (dimensionless)
UG	= Unit cost of replacement generation that is supplied to the grid (currency unit per unit of generation, e.g., USD/MWh)
G_y	= CFPP electricity generated and supplied to the grid in year y (MWh)
H	= Total blended tax rate (%)
$WACC_S$	= Weighted average cost of capital of stakeholder S (%)

The unit cost of replacement generation that is supplied to the grid (UG) must not increase throughout the financial assessment period and must be assumed to be constant in real terms.

CFPP generation (G_y) must be determined as per Section 9 and must be consistently applied across all required revenue calculations.

6.5.2.3 Unit Cost of Replacement Generation (UG)

The unit cost of replacement generation that is supplied to the grid (UG) must be estimated as the lower value of the average cost of generation in the grid (UG_{AVG}) and the cost of replacement generation in the project scenario (UC_{PS}).

$$UG = \text{MIN}(UG_{AVG}, UC_{PS}) \quad (6)$$

Where:

UG	=	Unit cost of replacement generation that is supplied to the grid (currency unit per unit of generation, e.g., USD/MWh)
UG_{AVG}	=	Average cost of generation in the grid (currency unit per unit of generation, e.g., USD/MWh)
UC_{PS}	=	Unit cost of replacement electricity generated and supplied to the grid in the project scenario (currency unit per unit of generation, e.g., USD/MWh)

Equation (7) calculates the average cost of generation in the grid in the year of the baseline scenario assessment.

$$UG_{AVG} = \frac{\sum_i (GU_i \times UG_i)}{\sum_i GU_i} \quad (7)$$

Where:

UG_{AVG}	=	Average cost of generation in the grid (currency unit per unit of generation, e.g., USD/MWh)
GU_i	=	Generation that is supplied to the grid from unit i (generation unit, e.g., MWh)
UG_i	=	Average unit cost of generation supplied to the grid by unit i (currency unit per unit of generation, e.g., USD/MWh)

Equation (8) calculates the unit cost of replacement generation in the project scenario (UC_{PS}).

$$UC_{PS} = \frac{(UG_{AVG} \times (G_y - GR)) + ((LCOE_{RE} - PLI) \times GR) + SA}{G_y} \quad (8)$$

Where:

UC_{PS}	=	Unit cost of replacement electricity generated and supplied to the grid in the project scenario (currency unit per unit of generation, e.g., USD/MWh)
UG_{AVG}	=	Average cost of generation in the grid (currency unit per unit of generation, e.g., USD/MWh)
G_y	=	CFPP electricity generated and supplied to the grid in year y (MWh)

GR	=	Annual paired renewable electricity generation that is supplied to the grid (generation unit, e.g., MWh)
$LCOE_{RE}$	=	Levelized cost of paired renewable electricity generation (currency unit per unit of generation, e.g., USD/MWh)
PLI	=	Production-linked incentives, which are output-based government subsidies paid to the generator (currency unit)
SA	=	Present value of the capital and fixed operating costs associated with supporting assets that provide energy storage and/or ancillary services (currency unit)

6.5.2.4 Levelized Cost of Paired Renewable Electricity Generation ($LCOE_{RE}$)

The levelized cost of paired renewable electricity generation is calculated as follows:

$$LCOE_{RE} = \frac{\sum_{t=0}^{t=L} ((EX_t + P_t + AC_t \times (1 - H)) - (DEP_{RE,t} \times H) + CAR_t) / (1 + K_e)^t}{\sum_{t=0}^{t=L} GR \times (1 - H) / (1 + K_e)^t} \quad (9)$$

Where:

$LCOE_{RE}$	=	Levelized cost of paired renewable electricity generation (currency unit per unit of generation, e.g., USD/MWh)
EX_t	=	Capital expenditure including equity return of capital and equity return on capital in year t (currency unit)
P_t	=	Principal payment for asset-level debt in year t (currency unit)
AC_t	=	Annual costs in year t calculated using Equation (3) with $FUEL_t$ equal to zero and substituting t for y as the year index (currency unit)
H	=	Total blended tax rate (%)
$DEP_{RE,t}$	=	Tax depreciation of renewable electricity asset in year t (currency unit)
CAR_t	=	Cost of carbon in year t (currency unit)
t	=	Project year since initial investment (years)
L	=	Renewable electricity plant lifetime (years)
K_e	=	Cost of equity to the facility owner (%)
GR	=	Annual paired renewable electricity generation that is supplied to the grid (generation unit, e.g., MWh)

To calculate $LCOE_{RE}$, project proponents must apply the relevant requirements in Appendix 2 of VT0009. The following additional guidance must be taken into account:

- 1) The initial capital investment must be assumed to be financed with at least 70% debt.

- 2) Renewable electricity generation must be estimated using at least the P50 energy yield³ arising from an independently prepared resource assessment, prepared by a qualified firm with prior experience conducting such studies.

6.5.2.5 Capital Expenditure Costs (EX_y)

Capital expenditure costs, including equity return of capital and equity return on capital, are amortized over the remaining lifetime of the asset.⁴

$$EX_y = \frac{EV \times K_e \times (1 + K_e)^{L_a}}{(1 + K_e)^{L_a} - 1} \quad (10)$$

Where:

EX_y	= Capital expenditure including equity return of capital and equity return on capital in year y (currency unit)
EV	= Equity value of asset (currency unit)
K_e	= Cost of equity to the facility owner (%)
L_a	= Lifetime of CFPP asset from commissioning until retirement (years)

L_a is the technical lifetime for a utility-owned CFPP or the end of the PPA term for an IPP-owned CFPP.

The equity value of the asset (EV) should be determined based on the share of equity in the upfront investment (i.e., the initial investment cost of the CFPP minus any project-level debt) plus any accumulated maintenance capital expenditure and future maintenance capital expenditure. For the purposes of calculation, maintenance capital expenditure is assumed to have occurred at the time of initial CFPP investment.⁵

$$EV = E + AMC + FMC \quad (11)$$

Where:

EV	= Equity value of asset (currency unit)
E	= Equity portion of initial investment (currency unit)
AMC	= Accumulated maintenance capital expenditure until project registration year (currency unit)
FMC	= Expected future maintenance capital expenditure until two (2) years prior to retirement year (currency unit)

³ Median energy yield, with 50% probability that this yield will be met or exceeded

⁴ This approach is recommended as upfront investment costs will have been made prior to project registration and financial analysis.

⁵ This is conservative as it increases the costs in the continued operation scenario, making retirement financially attractive earlier.

6.5.2.6 Costs of Carbon (CAR_y)

Costs of carbon (CAR_y) must be included where a carbon pricing scheme exists or is planned. The carbon price must be determined as follows:

- 1) Where a regulator or government agency in the host country has published a schedule of expected carbon prices, this schedule must be used when projecting future carbon costs.
- 2) Where several pricing scenarios are available, the most ambitious (i.e., highest price) must be applied.
- 3) Where a regulator or government agency in the host country has only published a range of expected carbon costs for its carbon pricing scheme, the carbon cost must be assumed to increase linearly to the maximum value in the range over the period for which the range is forecasted.
- 4) Where the assessment period extends beyond the published schedule or range of prices, the carbon cost must be projected forward using a linear trendline and the values determined above.

The cost of carbon should be calculated based on the emission factor of the CFPP, its generation, and the carbon price.

$$CAR_y = CP_y \times \sum_i (G_{i,y} \times EF_i) \quad (12)$$

Where:

CAR_y	= Cost of carbon in year y (currency unit)
CP_y	= Carbon price in year y (currency unit per unit of emissions, e.g., USD/tCO ₂ e)
$G_{i,y}$	= Generation of plant or unit i in year y (generation unit, e.g., MWh)
EF_i	= Emission factor of plant or unit i (emissions per unit of generation, e.g., tCO ₂ e/MWh)

The emission factor of the plant (EF_i) is calculated as the three-year average annual emission factor. Where asset-level emissions data are unavailable, an emission factor determined using Equation (13) must be used.

$$EF_i = \frac{1}{3} \times \sum_{y=REG-3}^{y=REG} \frac{EM_{i,y}}{G_{i,y}} \quad (13)$$

Where:

EF_i	= Emission factor of plant or unit i (emissions per unit of generation, e.g., tCO ₂ e/MWh)
$EM_{i,y}$	= Emissions of plant or unit i in year y (emissions unit, e.g., tCO ₂ e)
$G_{i,y}$	= Generation of plant or unit i in year y (generation unit, e.g., MWh)

REG = Year of project registration

6.5.2.7 Contract Termination Costs ($TERM_{AR}$)

In the baseline retirement scenario that involves PPA termination by the off-taker, PPA termination costs should be assumed to be borne by the off-taker in the CFPP retirement year. These termination costs should be determined based on the existing terms of the PPA between the CFPP and off-taker at the time of project validation. Where this information is unavailable, the PPA termination cost must be considered to be zero (0). Contract termination costs must not include additional costs to cover termination of the CFPP's fuel supply agreement or operations and maintenance agreements.

$$TERM_{AR} = NBV_{R0} - \left(\left(\frac{NBV_{R0}}{RY - R0} \right) \times (AR - R0) \right) \quad (14)$$

Where:

$TERM_{AR}$	=	Contract termination costs in accelerated retirement year AR ; equal to zero (0) for continued operation (CO) (currency unit)
NBV_{R0}	=	Net book value of CFPP asset in baseline assessment year $R0$ (currency unit)
RY	=	Retirement year of CFPP in (technical or end of PPA as per scenario) (years)
AR	=	Accelerated retirement year of CFPP (years)
$R0$	=	Baseline assessment year $R0$ (years)

For retirement scenarios in which a regulated utility retires its own CFPP:

- Early fuel supply agreement termination costs may be considered where the fuel supply agreement existing at the time of project implementation would expire after the expected early retirement of the CFPP. These early termination costs must be based on the existing terms of the fuel supply agreement.
- Early operations and maintenance agreement termination costs may be considered where the operations and maintenance agreements existing at project registration would expire after the expected early retirement of the CFPP. These early termination costs must be based on the existing terms of the operations and maintenance agreement.

6.5.2.8 Decommissioning Costs ($DC_{S,RY}$)

Decommissioning costs used in Equations (2) and (4) must reflect the costs borne by the stakeholder in question. Typically, off-takers bear no cost associated with CFPP decommissioning, if that can be demonstrated, a value of zero is used for DC_{RY} . For CFPP owners, there may be a difference between the gross cost of decommissioning and the net cost they are liable to pay, due to government or other third-party financial assistance.

Where decommissioning cost estimates are available as an “overnight” cost as at the time of CFPP retirement, that value may be used. Where more detailed schedules of decommissioning costs are available for a multi-year program of activities, Equation (15) must be used.

$$DC_{S,RY} = \sum_{D=0} \frac{(DC_{S,gross,D}) - (FA_{S,D})}{(1-H)/(1+K_e)^D} \quad (15)$$

Where:

$DC_{S,RY}$	=	Present value of decommissioning costs as of accelerated retirement year AR or retirement year RY for continued operation (CO) (currency unit)
RY	=	Retirement year (dimensionless)
D	=	Year of decommissioning period (i.e., 0, 1, 2, 3, etc.)
$DC_{S,gross,y}$	=	Gross decommissioning costs payable by stakeholder S in year D (currency unit)
$FA_{S,y}$	=	Financial assistance accruing to stakeholder S in year D (currency unit)
K_e	=	Cost of equity to stakeholder S (%)
H	=	Total blended tax rate (%)

6.5.2.9 Supporting Assets

Intermittent renewable generation often benefits from complementary assets, including energy storage and assets specialized in providing ancillary services (e.g., voltage and frequency support). The capital costs and fixed maintenance costs associated with these complementary assets contribute to the cost structure of a paired renewable energy solution. To be conservative, the variable operating costs of these assets are excluded, as the uncertainty associated with forecasting the future operating regime of these assets is significant.

$$SA = \sum_{t=0}^{t=L} \frac{SAEX_t + ACSA_t}{(1-H)/(1+K_e)^t} \quad (16)$$

Where:

SA	=	Present value of the capital and fixed operating costs associated with supporting assets that provide energy storage and/or ancillary services (currency unit)
t	=	Project year since initial investment (years)
L	=	Supporting asset plant lifetime (years)
$SAEX_t$	=	Supporting asset capital expenditures in year t (currency unit)
$ACSA_t$	=	Cost of supporting assets in year t (currency unit)
H	=	Total blended tax rate (%)
K_e	=	Cost of equity to stakeholder S (%)

Capital expenditures, including the return of and on equity capital for each supporting asset, are amortized over the lifetime of each asset.

$$SAEX_t = \frac{SAEV_a \times K_e \times (1 + K_e)^{L_a}}{(1 + K_e)^{L_a} - 1} \quad (17)$$

Where:

- $SAEX_t$ = Supporting asset capital expenditures in year t (currency unit)
- $SAEV_a$ = Equity value of asset a (currency unit)
- K_e = Cost of equity to the facility owner (%)
- L_a = Lifetime of asset a from commissioning until retirement (years)

For the purposes of calculation, maintenance capital expenditure is assumed to have occurred at the time of initial CFPP investment.

$$SAEV = E + AMC + FMC \quad (18)$$

Where:

- $SAEV$ = Equity value (currency unit)
- E = Equity portion of initial investment (currency unit)
- AMC = Accumulated maintenance capital expenditure until project registration year (currency unit)
- FMC = Expected future maintenance capital expenditure until two years prior to retirement year (currency unit)

The annual operating costs associated with all supporting assets must be calculated according to the following equation. This deliberately omits variable costs to be conservative in the overall estimate of SA in Equation (8).

$$ACSA_y = \sum_a IDEBT_{a,y} + FOM_{a,y} \quad (19)$$

Where:

- $ACSA_y$ = Cost of supporting assets in year y (currency unit)
- $IDEBT_{a,y}$ = Interest payment for asset-level debt for supporting asset a in year y (currency unit)
- $FOM_{a,y}$ = Fixed operations and maintenance costs for supporting asset a in year y (currency unit)

6.5.2.10 Production-Linked Incentives

Government subsidies for renewable energy are sometimes structured in the form of production-linked incentives. These programs augment revenues by paying generators as a function of energy produced. Where this revenue exists, the levelized cost of renewable generation ($LCOE_{RE}$ in Equation (8)) is offset.

$$PLI = \frac{\sum_{t=0}^{t=L} GR_t \times PLIR_t}{\sum_{t=0}^{t=L} GR_t \times (1 - H)/(1 + K_e)^t} \quad (20)$$

Where:

PLI	= Production-linked incentives, which are output-based government subsidies paid to the generator (currency unit)
t	= Project year since initial investment (years)
L	= Renewable electricity plant lifetime (years)
GR_t	= Paired renewable electricity generation that is supplied to the grid in year t (generation unit, e.g., MWh)
$PLIR_t$	= Project linked incentive rate in year t (currency unit per generation unit, e.g., USD/MWh)
H	= Total blended tax rate (%)
K_e	= Cost of equity to the facility owner (%)

Where production-linked incentives take the form of non-refundable tax credits, monetization of the incentives is delayed relative to the generation profile and the following equation applies:

$$PLI = \frac{\sum_{t=0}^{t=L} MTC_t}{\sum_{t=0}^{t=L} GR_t \times (1 - H)/(1 + K_e)^t} \quad (21)$$

Where:

PLI	= Production-linked incentives, which are output-based government subsidies paid to the generator (currency unit)
t	= Project year since initial investment (years)
L	= Renewable electricity plant lifetime (years)
MTC_t	= Monetized production-linked tax credits in year t (currency unit)
GR_t	= Paired renewable electricity generation that is supplied to the grid in year t (generation unit, e.g., MWh)
H	= Total blended tax rate (%)
K_e	= Cost of equity to the facility owner (%)

7 ADDITIONALITY

This module uses a project method and the tests in Sections 7.1–7.2.3 to demonstrate additionality. Projects are additional where the conditions of three (3) tests are met.

7.1 Regulatory Surplus

Project proponents must demonstrate regulatory surplus in accordance with the rules and requirements set out in the applicable version of the *VCS Standard*. Project proponents also demonstrate regulatory surplus through Section 6.1 in this module.

7.2 Investment analysis

Project proponent must demonstrate that the project activities would not be the most attractive scenario economically without revenue from carbon credits using the investment analysis presented in Section 6.5.1.

7.2.1 Financial Indicator

Net present value (NPV) is used as the financial indicator for investment comparison analysis in the process detailed in Section 6.5 of this module.

7.2.2 Investment Comparison

To demonstrate additionality, project proponents must conduct a comparative investment analysis for the year in which the project activities began using Equation 1 in Section 6.5.1.

Equation (1 compares the NPVs of two (2) mutually exclusive scenarios: the continued operation of the CFPP (the CO scenario) and the accelerated retirement of the CFPP and pairing with renewable and grid electricity (the AR scenario) with the latter representing the project activities.

If the condition presented in Equation 1 is not met, the accelerated retirement scenario is confirmed to not be the most economically attractive scenario in the year of analysis, and the project is deemed additional.

In contrast, the year in which Equation 1 is true represents the year in the project activities are financially attractive, revenue from carbon credits is not needed to advance the project activities, and the project is not considered additional.

To be deemed additional, project proponents must demonstrate that the condition presented in Equation 1 is not met for the year of the initial crediting period start date.

7.2.3 Sensitivity Analysis

A sensitivity analysis must be performed to demonstrate that the conclusion regarding the additionality generated in Section 7.2.2 is robust to reasonable variation ($\pm 10\%$) in the critical assumptions. Specifically, to be valid, the project proponent must demonstrate that the inequality in Equation 1 remains unsatisfied even with reasonable variation to the NPVs for both scenarios.

7.3 Common Practice

The steps in Sections 7.1 and **Error! Reference source not found.** must be complemented with an analysis of the extent to which the proposed project type (i.e., accelerated retirement) has already diffused in the relevant sector and applicable geographic area.

The geographic region must be established in accordance with Step 5.1 of VT0009. Relevant factors for limiting the applicable geographic area to a specific geographic area within the host country may include:

- 1) differences in regional policies, regulations, or market mechanisms
- 2) variations in electricity market conditions, power sector structure, ownership models, or contractual arrangements
- 3) differences in grid infrastructure, transmission access, or renewable integration capacity
- 4) differences in coal supply logistics or fuel costs

The common practice analysis must be conducted following the procedures and requirements in Step 4c of VT0009, with the following additional guidance:

- The common practice analysis must only consider the early retirement of the CFPP and not the paired renewable electricity.
- Project proponents must identify the number of CFPPs that have been or pledged to be retired early in the 10-year period preceding the commitment date of the project.
- N_{all} is the total number of CFPPs that have been, or pledged to be, retired early in the 10-year period preceding the commitment date of the project (excluding activities registered with the VCS Program or other GHG programs per VT0009).
- N_{diff} is the total number of CFPPs with essential distinctions that have been, or pledged to be, retired early in the 10-year period preceding the commitment date of the project (excluding those CFPPs using one of the scenarios detailed in Sections 6.1–6.5).

Where the outcome of this step (Section 7.3) based on the criteria in Step 4c of VT0009 is that the proposed project activity is not considered common practice, and the previous steps in Sections 7.1 and **Error! Reference source not found.** are met, the proposed project activity is additional.

Where the outcome of this step is that the proposed project activity is considered common practice, then it is not additional.

8 UNCERTAINTY ASSESSMENT

Proponents must use the sensitivity analysis in Section 7.2.3 to demonstrate that the conclusions made in Sections 6.5.1 and 7.2.2 are robust to $\pm 10\%$ variation in the parameters used in the investment analysis. As this approach applies to all the parameters, further assessment of uncertainty is not required.

9 DATA AND PARAMETERS

9.1 Data and Parameters Available at Validation

Data/Parameter	P_y P_t
Data unit	currency unit
Description	Principal payment for asset-level debt in year y Principal payment for asset-level debt in year t
Equations	(2) (9)
Source of data	CFPP financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Debt service costs include asset-level debt that was used to finance the initial investment in the CFPP, refinancing asset-level debt, and new debt issuance (e.g., under a committed CTM). Debt service costs must be calculated according to the terms of the existing financing agreement. The after-tax cost of debt must be used in the analysis.
Purpose of data	Determination of baseline scenario
Comments	Where a CFPP would be retired before the end of its existing loan tenor, it may be assumed that the remaining principal on unpaid debt must be fully repaid in retirement year AR .

Data/Parameter	CTM_y
Data unit	currency unit
Description	Revenue due to a coal transition mechanism in year y
Equations	(2)
Source of data	CTM financial documentation
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	CTM financial documentation will include information on additional revenue provided.
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	H
Data unit	%
Description	Total blended tax rate
Equations	(2), (4), (5), (9), (15), (16), (20), (21)
Source of data	Local tax documentation
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	$DEP_{CFPP,y}$
Data unit	currency unit
Description	Tax depreciation of CFPP asset in year y
Equations	(2)
Source of data	CFPP financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Tax depreciation must reflect existing policies or tax codes. Where no such policies exist, depreciation costs should be estimated assuming straight-line depreciation of the net book value of the CFPP over the remaining technical life of the CFPP; divide net book value of CFPP in year of analysis by remaining technical life to obtain $DEP_{CFPP,y}$.
Purpose of data	Determination of baseline scenario
Comments	Technical life must be determined according to A6.4-AMT-006.

Data/Parameter	$TERM_{AR}$
Data unit	currency unit
Description	Contract termination costs in accelerated retirement year AR
Equations	(2), (4), (14)
Source of data	PPAs or calculated as per Equation (14) or set to zero (0) where not available
Value applied	Project specific
Justification of choice of data or description of measurement methods and procedures applied	PPAs usually specify contract termination costs based on the year in which the contract is terminated.
Purpose of data	Determination of baseline scenario
Comments	Equal to zero (0) for continued operation (CO)

Data/Parameter	$WACC_S$
Data unit	%
Description	Weighted average cost of capital of stakeholder S
Equations	(2), (4), (5)
Source of data	CFPP financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	<p>Calculated based on the cost of equity, share of the initial CFPP investment financed through equity, share of the initial investment financed through asset-level debt, and cost of asset-level debt as follows:</p> $WACC_S = (K_{e,S} \times w_{e,S}) + (K_{d,S} \times w_{d,S})$ <p>Where:</p> <p>$K_{e,S}$ = Cost of equity for stakeholder S (%)</p> <p>$w_{e,S}$ = Share of initial CFPP investment financed by equity (%)</p> <p>$K_{d,S}$ = Cost of asset-level debt on CFPP owned by stakeholder S (%)</p> <p>$w_{d,S}$ = Share of initial CFPP investment financed by asset-level debt (%)</p>
Purpose of data	Determination of baseline scenario
Comments	<p>For plants owned by a regulated utility, the WACC represents the owner's cost of capital. For plants owned by an IPP, the WACC must represent the IPP's cost of capital in Equation (2), and the off-taker's cost of capital in Equation (4).</p> <p>For utilities and single-buyer PPA off-takers, the cost of equity must reflect regulated return.⁶ The shares of equity and debt and cost of asset-level debt should be based on historical audited data, given investment in the CFPP will have already occurred.</p>

Data/Parameter	$DC_{S,RY}$
Data unit	Currency unit

⁶ Future updates to this module may include considerations for merchant CFPPs that do not have regulated return.

Description	Present value of decommissioning costs as of accelerated retirement year <i>AR</i> or retirement year <i>RY</i> for continued operation (<i>CO</i>)
Equations	(2), (4), (15)
Source of data	Estimates developed for the project
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Operating CFPPs may not have a detailed and current estimate for decommissioning costs available, and are even less likely to have an estimate for a potential accelerated retirement. Thus, the development of such estimates for the project are likely required. CFPP decommissioning is a well-understood proposition, even if important details tend to be site-specific. Project proponents are expected to be readily able to procure an estimate from qualified third parties with prior experience in CFPP decommissioning.
Purpose of data	Determination of costs arising from CFPP decommissioning for purposes of determining the financially attractive retirement date
Comments	This variable is stakeholder-specific, to align with Equations (2) and (4). It refers to costs attributable to the stakeholder in question, net of financial assistance from government or other third parties. In most cases, it is expected that the off-taker would bear no costs associated with decommissioning, in which case this variable may be set to zero (0).

Data/Parameter	<i>IDEBT_y</i>
Data unit	currency unit
Description	Interest payment for asset-level debt in year <i>y</i>
Equations	(3)
Source of data	CFPP financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Debt service costs include asset-level debt that was used to finance the initial investment in the CFPP, refinancing asset-level debt, and new debt issuance (e.g., under a committed CTM). Debt service costs must

	be calculated according to the terms of the existing financing agreement. The after-tax cost of debt should be used in the analysis.
Purpose of data	Determination of baseline scenario
Comments	Where a CFPP would be retired before the end of its existing loan tenor, it may be assumed that the remaining principal on unpaid debt must be fully repaid in retirement year <i>AR</i> .

Data/Parameter	VOM_y FOM_y
Data unit	currency unit
Description	Variable operations and maintenance costs in year <i>y</i> Fixed operations and maintenance costs in year <i>y</i>
Equations	(3)
Source of data	CFPP financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Fixed and variable operations and maintenance costs should be based on historical data over the previous five years prior to project registration. Where fewer than five years of operational data exist, the average of historical fixed and variable operations and maintenance costs over the entire lifetime of the CFPP must be used. These costs must be assumed to be fixed in real terms in the baseline assessment.
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	$FUEL_y$
Data unit	currency unit
Description	Fuel costs in year <i>y</i>
Equations	(3)

Source of data	CFPP financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Fuel costs should be based on historical data over the previous five (5) years prior to the date of baseline scenario assessment and must include fuel transportation costs. Where fewer than five (5) years of operational data exist, the average historical fuel costs over the entire lifetime of the CFPP must be used. Fuel costs must be fixed in real terms for baseline scenario analysis.
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	$PPAE_y$
Data unit	Currency unit per unit of generation (e.g., USD/MWh)
Description	Remuneration for electricity supplied to the grid under PPA contract in year y
Equations	(4)
Source of data	CFPP PPA terms
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	G_y $G_{i,y}$
Data unit	Generation unit (e.g., MWh)

Description	CFPP electricity generated and supplied to the grid in year y Generation of plant or unit i in year y
Equations	(4), (5), (8) (12), (13)
Source of data	CFPP use/generation records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Calculated as historical averages for the CFPP over the last five (5) years. Where fewer than five years of operational data exist, the average of historical generation over the entire lifetime of the CFPP must be used. Where the CFPP has an existing PPA with a take-or-pay clause, the take-or-pay levels set in the PPA must be used as a minimum for G_y .
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	$PPAC_y$
Data unit	Currency unit per unit of available capacity
Description	Remuneration for available capacity under PPA contract in year y
Equations	(4)
Source of data	CFPP PPA terms
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	A_y
Data unit	Capacity unit
Description	Availability of CFPP capacity as per PPA in year y
Equations	(4)
Source of data	CFPP PPA terms
Value applied	Calculated as historical averages of the CFPP over the last five (5) years. Where fewer than five (5) years of operational data exist, the average historical availability over the entire lifetime of the CFPP must be used.
Justification of choice of data or description of measurement methods and procedures applied	Historical data is best representation of future performance.
Purpose of data	Determination of baseline scenario
Comments	<p>A_y is the capacity of the CFPP that is available and used to determine the remuneration for available capacity under a PPA contract in year y.</p> <p>Availability is assumed to remain constant throughout the analysis period.</p>

Data/Parameter	$PPAS_y$
Data unit	Currency unit per unit of service
Description	Remuneration for other electricity services in year y
Equations	(4)
Source of data	CFPP PPA terms
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A

Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	OS_y
Data unit	Service unit
Description	Other yearly services provided by the CFPP in year y
Equations	(4)
Source of data	CFPP PPA terms
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	GU_i
Data unit	Generation unit (e.g., MWh)
Description	Generation that is supplied to the grid from unit i
Equations	(7)
Source of data	Grid operator data
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A

Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	UG_i
Data unit	Currency unit per unit of generation (e.g., USD/MWh)
Description	Average unit cost of generation supplied to the grid by unit i
Equations	(7)
Source of data	Grid operator data
Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	GR GR_t
Data unit	Generation unit (e.g., MWh)
Description	Annual paired renewable electricity generation that is supplied to the grid Paired renewable electricity generation that is supplied to the grid in year t
Equations	(8), (9) (20), (21)
Source of data	Paired renewable electricity estimated to be exported to the grid

Value applied	N/A
Justification of choice of data or description of measurement methods and procedures applied	Estimated based on P50 energy yield from an independent resource assessment as required in Section 6.5.2.4
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	SA
Data unit	Currency unit
Description	Present value of the capital and fixed operating costs associated with supporting assets that provide energy storage and/or ancillary services
Equations	(8), (16)
Source of data	Estimates developed for the project
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Supporting assets (including, for illustrative purposes, battery energy storage systems and synchronizing condensers) can complement paired renewable energy by mitigating the intermittent nature of renewable energy production and providing valuable ancillary services including voltage and frequency support that are not otherwise provided by the renewable generation itself. As the development of these assets will typically be linked with the paired renewable energy, it is logical that cost estimates associated with these assets would be developed as a part of normal project development.
Purpose of data	Determination of capital and fixed operating costs associated with one (1) or more supporting assets developed to complement the paired renewable energy
Comments	The scope of the costs included in variable SA is limited to capital and fixed operating costs to be conservative; it can be more difficult to reach consensus regarding the likely operating regime of such assets than for conventional generation, and any such forecast is inherently complex.

Data/Parameter	K_e
Data unit	%
Description	Cost of equity to the facility owner
Equations	(9), (10), (15), (16), (17), (20), (21)
Source of data	Facility financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	$DEP_{RE,t}$
Data unit	Currency unit
Description	Tax depreciation of renewable electricity asset in year t
Equations	(9)
Source of data	Local tax documentation
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Tax depreciation must reflect existing policies or tax codes that would provide a tax benefit to renewable energy technologies. Where no such policies exist, straight-line depreciation over the project lifetime may be assumed.
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	L_a
Data unit	Years
Description	Lifetime of CFPP asset from commissioning until retirement
Equations	(10)
Source of data	CFPP records
Value applied	Utility-owned CFPP: technical lifetime IPP-owned CFPP: end of PPA term
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	E
Data unit	Currency unit
Description	Equity portion of initial investment
Equations	(11)
Source of data	CFPP financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Equity portion of initial investment must be demonstrated with historical documentation that has third party corroboration to support validation. This includes audited corporate financial records that demonstrate equity portion of initial investment, or when they do not demonstrate equity portion of initial investment well, combinations of audited financial statements and tax records, third party debt statements /schedules, investor agreements, submissions to regulator for ratepayer changes, or similar must be used.

Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	AMC
Data unit	Currency unit
Description	Accumulated maintenance capital expenditure until project registration year
Equations	(11)
Source of data	CFPP financial records
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Must be based on historical spending with invoices or equivalent demonstrable records of spending
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	FMC
Data unit	Currency unit
Description	Expected future maintenance capital expenditure until two (2) years prior to retirement year
Equations	(11)
Source of data	CFPP records
Value applied	As determined from source data
Justification of choice of data or description of	Future maintenance capital expenditure must be based on existing maintenance contracts with third parties and must assume no additional maintenance capital expenditure in the two (2) years prior to

measurement methods and procedures applied	CFPP retirement. Where maintenance contracts are unavailable, future maintenance capital expenditure may be projected using historical spending on invoices, or equivalent demonstrable records of spending.
Purpose of data	Determination of baseline scenario
Comments	

Data/Parameter	CP_y
Data unit	Currency unit per unit of emissions (e.g., USD/t CO ₂ e)
Description	Carbon price in year y
Equations	(12)
Source of data	Regulatory documentation on carbon price/price pathway
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Carbon price values for each year over the life of the CFPP must be determined by assuming annual growth of carbon prices (e.g., carbon tax, emissions trading scheme allowance price) in accordance with host country plans or policy scenarios at the time of validation. Where the length of the assessment period exceeds the period over which a carbon price target is set or forecasted, the carbon price to be applied to the remaining years is the carbon price corresponding to the final year for which an official target or forecast price exists, projected forward using a linear trendline based on the average rate of change in carbon prices over the last five (5) years of available data, or forecasted according to government sources. Where several pricing scenarios are available, apply the most ambitious (i.e., highest) carbon price.
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	$EM_{i,y}$
Data unit	Emissions unit (e.g., tCO ₂ e)
Description	Emissions of plant or unit i in year y

Equations	(13)
Source of data	CFPP emissions reporting
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	NBV_{R0}
Data unit	Currency unit
Description	Net book value of CFPP asset in baseline assessment year $R0$
Equations	(14)
Source of data	CFPP financial accounts
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	N/A
Purpose of data	Determination of baseline scenario
Comments	None

Data/Parameter	$PLIR_t$
Data unit	Currency unit per generation unit (e.g., USD/MWh)

Description	Project linked incentive rate in year t
Equations	(20)
Source of data	Policy documentation describing the production-linked incentive
Value applied	As determined from source data
Justification of choice of data or description of measurement methods and procedures applied	Where production-linked incentives exist, they may be subject to escalation accounting for inflation, evolving policy goals, or other reasons. Public information about these policy tools should be used as the basis for establishing the rate applicable to the renewable energy generation involved in the project.
Purpose of data	To be used to determine the value of production-linked incentives in offsetting the unit cost of replacement generation
Comments	None

Data/Parameter	MTC_t
Data unit	Currency unit
Description	Monetized production-linked tax credits in year t
Equations	(21)
Source of data	Project analysis based on structure of the tax credit and projected tax obligations arising over time
Value applied	As determined from project analysis
Justification of choice of data or description of measurement methods and procedures applied	Non-refundable production tax credits are a specific implementation of production-linked incentives that result in a delay between when credits are earned (as a function of production) and when they can be monetized. Owing to this difference in time and relationship with forecast tax obligations, a project-specific analysis is required to determine the projected monetizable value over time.
Purpose of data	To be used to determine the value of production-linked incentives in offsetting the unit cost of replacement generation
Comments	None

9.2 Data and Parameters Monitored

None

10 REFERENCES

None

DOCUMENT HISTORY

Version	Date	Comment
v1.0	6 May 2025	Initial version
v1.1	30 Oct 2026	<p>Minor revision including the following updates:</p> <ul style="list-style-type: none"> • Section 2 – <i>CDM TOOL10</i> was replaced by A6.4-AMT-006 (Paris Agreement Crediting Mechanism) for working out the technical lifetime of equipment. • Section 5.1 - updated to use <i>VT0009 Combined Baseline and Additionality Assessment</i> to determine geographic area for baseline scenario determination and the alternative scenarios changed to include CFPP switching to natural gas, removed temporal limit on the use of scenario B3 and added scenario B4. • Section 5.2 – removed counterfactual pairing pathway • Sections 6.1 through 6.51 – “enabling scenario” subsection removed, Equation 1 changed to test whether the <i>AR</i> scenario costs are “equal to or lower than” those of the <i>CO</i> scenario • Section 6.5.2 – revisions to terminology in Approaches 1 and 2, revisions parameters to improve clarity, new subsections added for Decommissioning Costs, Supporting Assets, and Production Linked Incentives • Section 7 – direction on additionality testing requirements and procedures improved for clarity, section 7.2.3 Sensitivity Analysis added • Section 8 – uncertainty assessment replaced by sensitivity analysis • Section 9 – parameters tables added for new costs in section 6.5.2